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Refoma Core | Foundations of Mathematics | 2026

OPEN SOURCE

This book introduces the fundamentals of open-source software and tools. It explores the philosophy of open source, essential software platforms, and practical tools used in modern development, with a focus on accessibility, collaboration, and real-world usage.

Abdeljalil Mostefaoui | Echahid Cheikh Larbi Tebessi university

Book of Open Source

Lessons, Exercises, and Fully-Solved Practice Exams

Refoma Core — Open Source

Professor: Thabet Khawla

Author: Abdeljalil Mostefaoui

Field: Mathematics / Computer Science

Level: First Year University

University: Echahid Cheikh Larbi Tebessi University

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This work is a humble pursuit of knowledge, devoted to intellectual growth, sincere learning, and the pleasure of ones parents, in the hope of earning the pleasure of Allah.

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Chapter 1

Chapter 1: Information Technologies

1.1 Comprehensive Summary

1.1.1 Introduction to Information Technology (IT)

Information Technology refers to the use of computers, networks, and electronic systems to **collect, process, store, and share data**.

- **Importance:** It supports communication, business, research, and daily life.
- **Academic Relevance:** Crucial for Math and CS students to understand algorithms and digital systems.
- **Skills:** Promotes critical thinking, problem-solving, and leads digital transformation.

1.1.2 Robotics and Educational Tools

Robotics combines Computer Science, Engineering, Mathematics, and Electronics. The course highlights three key tools for beginners:

1. **Blockly:**
   - A visual programming language using *drag-and-drop* blocks.
   - Ideal for beginners (ages 6-12) to learn logic without syntax errors.
   - Used in games (Blockly Games: Maze, Bird, Turtle) and robotics kits.
2. **Scratch:**
   - Developed by MIT. A block-based platform for interactive stories, games, and animations.
   - Concepts: Sprites (characters), Costumes, Stage, and Scripts (Motion, Looks, Sound, Control).
3. **Arduino:**
   - A microcontroller board (hardware) that acts as the "brain" of a robot.
   - **Function:** Reads sensors (inputs) and controls motors/lights (outputs).
   - **Workflow:** Write code on PC → Upload via USB → Arduino executes automatically.

1.1.3 Hardware Components

Hardware refers to the physical components of IT.

- **Core Units:** Computers (Desktops, Laptops, Servers).
- **Peripherals:** Input/Output devices (Printers, Scanners, Mice).
- **Communication Networks:**
  - **Modem:** Connects to the internet.

  - **Router:** Directs data between networks.
  - **Switch:** Connects devices within a single local network.

- **Smart Chips & IoT:**
  - **RFID (Radio Frequency Identification):** Used for tracking (Logistics, ID cards, Animals).
  - **IoT Sensors:** Monitor environments (Soil moisture in farming, heartbeat in healthcare).

1.1.4 Software Systems

Software enables hardware to perform tasks.

- **System Software:** Controls hardware (e.g., Windows, Linux, macOS).
- **Application Software:** Performs specific user tasks (e.g., Word, Games).
- **Business Applications:**
  - **ERP (Enterprise Resource Planning):** Integrates all departments (HR, Finance, Sales) into one system (e.g., SAP, Odoo).
- **Communication:** Intranet (Private), Extranet (Partners), Internet (Global).
- **EDI (Electronic Data Interchange):** Automated exchange of documents (invoices) between computers.

1.2 Key Notes & Observations

Crucial Distinctions

- **Switch vs. Router:** A switch connects devices in a *LAN* (Local Area Network); a router connects different *networks* (like your LAN to the Internet).
- **Hardware vs. Software:** Hardware is the physical machinery; Software is the set of instructions that tells the hardware what to do.
- **Blockly vs. Scratch:** Both are visual. Blockly is often a library used inside other apps (like robotics controls), while Scratch is a standalone creative community/platform by MIT.

- **Automation:** Smart chips (RFID/IoT) are the key enablers of modern automation in agriculture and logistics.
- **Integration:** The main value of ERP software is that it prevents data siloseveryone in the company sees the same real-time data.
- **Hands-on Learning:** The course emphasizes that understanding the software (Blockly code) and hardware (Arduino board) interaction is vital for robotics.

1.3 Multiple Choice Questions (QCM)

Click on the question number to see the answer.

Q1. Information Technology primarily involves:

a) Designing mechanical engines
b) Collecting, processing, storing, and sharing data
c) Chemical experimentation
d) Manual filing systems

Q2. Which of the following is NOT a benefit of IT in education?

a) Enhances critical thinking
b) Supports digital transformation
c) Reduces the need for problem-solving
d) Helps understanding of algorithms

Q3. Blockly is best described as:

a) A complex text-based coding language
b) A visual tool using drag-and-drop blocks
c) A hardware component for robots
d) A web browser

Q4. Scratch was developed by:

a) Google
b) Microsoft
c) MIT
d) NASA

Q5. In Scratch, the characters that act on the stage are called:

a) Actors
b) Sprites
c) Codes
d) Blocks

Q6. Which age group is Blockly primarily ideal for?

a) 6-12 years
b) 18-25 years
c) Professionals only
d) Toddlers

Q7. Which of these is a Blockly Game mentioned in the course?

a) Shooter
b) Maze
c) Racer
d) Builder

Q8. Arduino is essentially:

a) A software program only
b) A microcontroller board

c) A type of battery
d) A large server

Q9. How do you upload a program to an Arduino board?

a) Via Bluetooth only
b) Via USB connection
c) It cannot receive programs
d) Using a CD-ROM

Q10. What acts as the "brain" of the robot in an Arduino kit?

a) The wheels
b) The LED lights
c) The microcontroller board
d) The USB cable

Q11. Arduino inputs usually come from:

a) Motors
b) Sensors
c) Printers
d) Speakers

Q12. Which discipline is used in robotics for logic and motion?

a) Biology
b) Mathematics
c) History
d) Chemistry

Q13. Which device connects a local network to the internet?

a) Switch
b) Hub
c) Modem
d) Printer

Q14. A Network Switch is used to:

a) Broadcast data to all devices blindly
b) Efficiently connect devices within a local network
c) Print documents wirelessly
d) Connect a home to the ISP

Q15. Which of the following is considered a Peripheral?

a) CPU
b) Printer
c) Motherboard
d) Hard Drive

Q16. RFID stands for:

a) Radio Frequency Identification
b) Remote File Identification
c) Robotic Frequency ID

d) Real Fast Internet Data

Q17. Where would you likely find an IoT sensor in Agriculture?

a) Inside the farmer's pocket
b) In the soil measuring moisture
c) On the roof of the barn only
d) Inside the tractor's engine only

Q18. RFID tags on animals are usually used for:

a) Keeping them warm
b) Tracking and identification
c) Making them run faster
d) Feeding them automatically

Q19. Windows, Linux, and macOS are examples of:

a) Application Software
b) System Software
c) Business Software
d) Malware

Q20. Microsoft Word and Excel are examples of:

a) Operating Systems
b) Application Software
c) Hardware drivers
d) Network protocols

Q21. What does ERP stand for?

a) Electronic Repair Program
b) Enterprise Resource Planning
c) Efficient Resource Processing
d) External Routing Protocol

Q22. What is the main function of ERP?

a) To play video games
b) To manage all company departments in one system
c) To browse the internet securely
d) To design 3D graphics

Q23. Which network is private and used inside a company?

a) Internet
b) Extranet
c) Intranet
d) Ethernet

Q24. EDI helps businesses exchange documents:

a) Automatically without paper
b) By using postal mail
c) Via voice calls
d) Using fax machines

Q25. Video conferencing tools like Zoom are examples of:

a) System Software
b) Multimedia Applications
c) Hardware peripherals
d) IoT sensors

Q26. Without software, hardware would be:

a) Faster
b) More efficient
c) Useless
d) Smaller

Q27. An Extranet allows access to:

a) Everyone in the world
b) Only internal employees
c) Selected external users like suppliers
d) No one

Q28. Which is an example of an ERP software mentioned?

a) Scratch
b) SAP
c) Blockly
d) Skype

Q29. Smart chips in healthcare are often:

a) Printed on paper
b) Worn as wearables or patches
c) Stored in heavy servers
d) Connected via cables only

Q30. Robotics "Electronics" discipline handles:

a) Programming logic
b) Sensors and actuators
c) Building mechanical parts
d) Mathematical equations

1.4 Chapter Exam

Part 1: Definitions (5 Points)

Define the following terms clearly:

1. Information Technology (IT)
2. System Software
3. RFID
4. Intranet
5. Blockly

Part 2: Short Answer (8 Points)

1. Explain the difference between a **Router** and a **Switch**.
2. Describe the workflow of programming a robot using **Arduino** (3 steps).
3. List three (3) benefits of using **EDI** (Electronic Data Interchange) in business.
4. What makes **ERP** software essential for large companies?

Part 3: Application Scenario (7 Points)

You are asked to design a "Smart Farm".

1. Which specific hardware component (Smart Chip) would you use to monitor soil moisture?
2. Which specific hardware component would you use to track the location of the cows?
3. If you want to program a simple robot to water the plants automatically using blocks for logic, which beginner-friendly language would you use?
4. Explain how the sensor, the program, and the robot interact in this scenario.

1.5 Solutions: Multiple Choice Questions

Question	Answer	Link
1	B	Back to Q1
2	C	Back to Q2
3	B	Back to Q3
4	C	Back to Q4
5	B	Back to Q5
6	A	Back to Q6
7	B	Back to Q7
8	B	Back to Q8
9	B	Back to Q9
10	C	Back to Q10
11	B	Back to Q11
12	B	Back to Q12
13	C	Back to Q13
14	B	Back to Q14
15	B	Back to Q15
16	A	Back to Q16
17	B	Back to Q17
18	B	Back to Q18
19	B	Back to Q19
20	B	Back to Q20
21	B	Back to Q21
22	B	Back to Q22
23	C	Back to Q23
24	A	Back to Q24
25	B	Back to Q25
26	C	Back to Q26
27	C	Back to Q27
28	B	Back to Q28
29	B	Back to Q29
30	B	Back to Q30

1.6 Exam Solutions

Part 1: Definitions

1. **IT:** The use of computers, networks, and electronic systems to collect, process, store, and share data.
2. **System Software:** Software that controls and manages the computer's hardware and basic operations (e.g., OS like Windows).
3. **RFID:** Radio Frequency Identification; a smart chip technology used primarily for tracking products, IDs, or animals.
4. **Intranet:** A private network used inside a company to share information securely among employees.
5. **Blockly:** A visual programming tool using drag-and-drop blocks, ideal for beginners to understand logic.

Part 2: Short Answer

1. **Router vs. Switch:** A Router directs data between different networks (e.g., Home to Internet), while a Switch connects devices efficiently within the same local network.
2. **Arduino Workflow:**
   (a) Write the program on the computer (IDE).
   (b) Upload the program to the board via USB.
   (c) The Arduino executes the instructions automatically to control components.
3. **EDI Benefits:** Faster exchange, cheaper cost, and reduced human error.
4. **ERP Importance:** It integrates all departments (Sales, HR, Finance) into one system, ensuring accurate and organized data flow across the company.

Part 3: Application Scenario (Smart Farm)

1. **Soil Monitoring:** IoT Sensors (placed in the soil).
2. **Cow Tracking:** RFID Tags (injected or on collars).
3. **Programming Language:** Blockly or Scratch (Visual programming).
4. **Interaction:** The **IoT Sensor** detects low moisture → sends data to the **Program** (Logic) → The program triggers the **Robot/Actuator** to turn on the water valve.

Chapter 2

Chapter 2: Open Source Tools

2.1 Comprehensive Summary

2.1.1 Introduction to Open Source

Open-source software allows users to freely **access, study, modify, and share** the source code. Unlike proprietary software (owned by a single company), open source is maintained by a global community.

- **History:** Started with the *Free Software Movement* by **Richard Stallman**.
- **Key Milestones:**
  - 1983: GNU Project launch.
  - 1985: Free Software Foundation (FSF) & GNU Emacs.
  - 1991: Linux Kernel release.
- **Key Characteristics:** Free of charge, Transparent code, Flexible, Secure (community fixes), Collaborative.
- **Limitations:** Limited official support (reliance on community forums), inconsistent user interfaces.

2.1.2 Categories of Open Source Tools

The chapter categorizes tools into several domains:

1. **Operating Systems:**
   - *Linux Distros:* Ubuntu (User-friendly), Debian (Stable/Servers), Fedora (Developers), Kali (Security).
   - *Mobile:* Android (Built from Linux).
2. **Development Tools:**
   - *IDEs/Editors:* VS Code, Eclipse (Java), Atom, PyCharm Community.
   - *Version Control:* Git (Tracking changes), GitHub/GitLab (Hosting).
3. **Graphic & Multimedia:**
   - *Images:* GIMP (vs Photoshop), Inkscape (vs Illustrator).
   - *3D/Video:* Blender (vs Maya), OBS Studio (Streaming).
   - *Audio:* Audacity.
4. **Web & Communication:**
   - *Browsers/Mail:* Mozilla Firefox, Thunderbird.
   - *Chat/Meet:* Jitsi Meet (Open source alternative to Zoom), Rocket.Chat, Mattermost.

2.1.3 Office Productivity: LibreOffice

A free, open-source alternative to Microsoft Office. Developed by *The Document Foundation*.

- **Writer:** Word processing (.odt, .docx).
- **Calc:** Spreadsheets (.ods, .xlsx).
- **Impress:** Presentations (.odp, .pptx).
- **Draw:** Diagrams and graphics.
- **Base:** Database management.
- **Math:** Formula editor.

2.1.4 Collaboration Tools

Tools allowing teams to work together efficiently from different locations.

- **Types:** Communication (Slack), File Sharing (Nextcloud), Co-editing (Etherpad, LibreOffice Online), Task Management (OpenProject, Trello).
- **Benefits:** Saves time, version control, real-time updates.

2.1.5 Contributing to Open Source

Steps to contribute (Example using a Python Calculator):

1. **Setup:** Install Python and VS Code.
2. **Create:** Write the base code (e.g., ‘simple_calculator.py‘).
3. **Modify:** Add features (e.g., add multiplication function).
4. **Test:** Run code to ensure it works.
5. **Document:** Create a **README.md** using Markdown to explain the project.

2.2 Key Notes & Distinctions

Free Software vs. Open Source (Context of Course)

- **Free Software (Gratis):** You don't pay to use it, but you might not own it or see the code (e.g., Google Meet is free to use, but proprietary).
- **Open Source Software:** You can access, modify, and share the code (e.g., Jitsi Meet).

- **Android:** Is listed as an open-source OS because it is built from the Linux kernel, unlike iOS.
- **README File:** Essential for any project. It is usually written in **Markdown** syntax to format text easily.
- **Installation:** LibreOffice uses an '.msi' installer on Windows.

2.3 Multiple Choice Questions (QCM)

Click on the question number to view the solution.

Q1. Who founded the Free Software Foundation (FSF)?

a) Linus Torvalds
b) Bill Gates
c) Richard Stallman
d) Steve Jobs

Q2. Which project was launched in 1983 to create a free OS?

a) The Linux Project
b) The GNU Project
c) The Apache Project
d) The Windows Project

Q3. Which of the following is NOT a characteristic of open-source tools?

a) Transparent source code
b) Community collaboration
c) High license fees
d) Security through community review

Q4. Which Linux distribution is known for being very stable and used on servers?

a) Kali
b) Debian
c) Android
d) Windows 11

Q5. Kali Linux is specialized for:

a) Graphic Design
b) Office Productivity
c) Cybersecurity and Ethical Hacking
d) Music Production

Q6. Android OS is built from which kernel?

a) Unix
b) Windows NT
c) Linux
d) macOS

Q7. Which tool is used for Version Control?

a) Eclipse
b) Git
c) Firefox
d) Blender

Q8. A popular platform for hosting and sharing code is:

a) Photoshop
b) GitHub

c) Skype
d) Audacity

Q9. Visual Studio Code is primarily a:

a) 3D Modeler
b) Code Editor
c) Video Player
d) Spreadsheet tool

Q10. The open-source alternative to Adobe Photoshop is:

a) Inkscape
b) GIMP
c) Blender
d) Krita

Q11. Blender is used for:

a) Email management
b) 3D modeling and animation
c) Vector drawing
d) Screen recording

Q12. Which tool is used for screen recording and live streaming?

a) OBS Studio
b) VLC
c) Audacity
d) Impress

Q13. LibreOffice Writer is an alternative to:

a) Microsoft Excel
b) Microsoft PowerPoint
c) Microsoft Word
d) Adobe Reader

Q14. Which LibreOffice component is used for mathematical formulas?

a) Calc
b) Math
c) Draw
d) Base

Q15. To create a presentation, you would use:

a) LibreOffice Draw
b) LibreOffice Base
c) LibreOffice Impress
d) LibreOffice Calc

Q16. LibreOffice Base is compatible with which database engine?

a) MySQL
b) MongoDB only
c) NoSQL only

d) It has no compatibility

Q17. What is the file extension for a LibreOffice Calc spreadsheet?

a) .docx
b) .ods
c) .ppt
d) .txt

Q18. Mozilla Firefox is famous for focusing on:

a) Virtual Reality
b) Privacy and Speed
c) Cloud Gaming
d) Database management

Q19. An open-source alternative to Microsoft Teams is:

a) Zoom
b) Mattermost
c) Google Meet
d) WhatsApp

Q20. Jitsi Meet allows you to:

a) Edit photos
b) Hold video conferences
c) Write code
d) Clean viruses

Q21. Which of the following is a File Sharing/Cloud Storage tool?

a) Nextcloud
b) Audacity
c) GIMP
d) Python

Q22. Real-time typing and track changes are features of:

a) Image Editors
b) Co-editing tools
c) Video Players
d) Compilers

Q23. Trello and OpenProject are examples of:

a) Web Browsers
b) Project Management tools
c) Antivirus software
d) Operating Systems

Q24. A README file in a project is usually written in:

a) Binary code
b) Markdown syntax
c) C++
d) Assembly

Q25. Before sharing your code contribution, you must always:

a) Delete the original file
b) Test your changes
c) Pay a fee
d) Print the code

Q26. In the Python calculator example, what was the first step?

a) Installing Photoshop
b) Setting up the environment (Install Python/IDE)
c) Writing a game
d) Buying a computer

Q27. "Free Software" (like Google Meet free version) means:

a) You own the code
b) You can modify the engine
c) You don't have to pay to use it
d) It is open source

Q28. Which tool helps students manage references and citations?

a) Zotero
b) Paint
c) Calc
d) VLC

Q29. One limitation of open-source software is:

a) It is too expensive
b) It has viruses
c) Limited official customer support
d) It cannot be downloaded

Q30. Jupyter Notebook is primarily used for:

a) Video Editing
b) Data Science and Education
c) Graphic Design
d) Music Composition

2.4 Chapter Exam

Part 1: Definitions (5 Points)

Define the following terms clearly:

1. Open Source Software
2. Development Environment
3. LibreOffice Impress
4. Version Control System (Git)
5. Collaboration Tools

Part 2: Short Answer (8 Points)

1. List three (3) advantages (characteristics) of Open Source tools.
2. What is the difference between **GIMP** and **Inkscape**?
3. Explain the purpose of a **README.md** file in a project.
4. Name two (2) open-source alternatives to Microsoft Office components.

Part 3: Practical Scenario (7 Points)

Scenario: You are a student at Echahid Cheikh Larbi Tebessi University starting a group project on "Data Analysis". You want to use only Open Source tools.

1. Which **Operating System** would you recommend for the team (Developer friendly)?
2. Which tool would you use to write the collaborative report in **real-time**?
3. Which tool would you use for the **Data Science/Coding** part (Python)?
4. Which tool would you use to organize tasks and track the group's progress?

2.5 Solutions: Multiple Choice Questions

Q#	Ans	Link
1	C	Go to Q1
2	B	Go to Q2
3	C	Go to Q3
4	B	Go to Q4
5	C	Go to Q5
6	C	Go to Q6
7	B	Go to Q7
8	B	Go to Q8
9	B	Go to Q9
10	B	Go to Q10
11	B	Go to Q11
12	A	Go to Q12
13	C	Go to Q13
14	B	Go to Q14
15	C	Go to Q15
16	A	Go to Q16
17	B	Go to Q17
18	B	Go to Q18
19	B	Go to Q19
20	B	Go to Q20
21	A	Go to Q21
22	B	Go to Q22
23	B	Go to Q23
24	B	Go to Q24
25	B	Go to Q25
26	B	Go to Q26
27	C	Go to Q27
28	A	Go to Q28
29	C	Go to Q29
30	B	Go to Q30

2.6 Exam Solutions

Part 1: Definitions

1. **Open Source Software:** Software whose source code is freely accessible for anyone to study, modify, and share.
2. **Development Environment:** The set of tools (OS, editors, compilers) developers use to create and maintain software.
3. **LibreOffice Impress:** An open-source presentation tool similar to Microsoft PowerPoint, used to create slides.
4. **Git:** A version control system used to track changes in code during development.
5. **Collaboration Tools:** Digital applications that allow teams to communicate, share files, and manage tasks remotely.

Part 2: Short Answer

1. **Advantages:** Free of charge, Transparent (code inspection), Secure (community fixes), Flexible.
2. **GIMP vs Inkscape:** GIMP is for photo editing (raster graphics like Photoshop), while Inkscape is for vector drawing (like Illustrator).
3. **README.md Purpose:** It explains what the project does, how to install it, and how to use it (Documentation).
4. **Alternatives:**
   - Writer (for Word).
   - Calc (for Excel).

Part 3: Practical Scenario

1. **OS:** Fedora (Good for developers) or Ubuntu (User-friendly).
2. **Real-time Report:** Etherpad or LibreOffice Online.
3. **Data Science:** Jupyter Notebook.
4. **Task Management:** OpenProject or Trello (though Trello isn't fully open source, OpenProject is the best fit).

Review Page

Sources and References

This educational work was prepared based exclusively on the official lecture notes and course materials provided by:

Professor: Thabet Khawla

All theoretical content, definitions, and core explanations in this book are derived from these academic resources. The material has been reorganized, typeset, and presented in a clear pedagogical format using LaTeX for educational purposes only.

No external or unauthorized sources were used in the preparation of this document.

Final Word

This book was created with the intention of facilitating understanding, structuring knowledge, and supporting students in their academic journey.

If this work has helped you, even in a small way, I kindly ask you to remember my parents in your prayers and ask Allah to grant them mercy.

Knowledge is a trust, and sharing it is a responsibility. May this work be beneficial to everyone who reads it.

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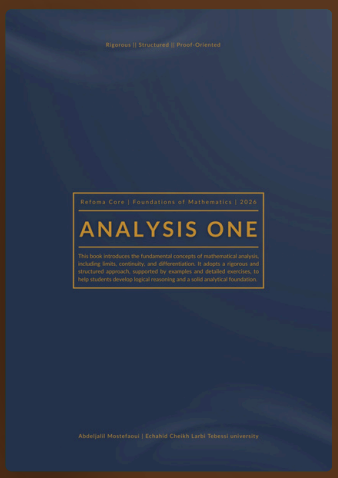
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Reloma Core | Foundations of Mathematics | 2026
ANALYSIS ONE
This book introduces the fundamental concepts of mathematical analysis, including limits, continuity, and differentiation. It adopts a rigorous and structured approach, supported by examples and detailed exercises, to help students develop logical reasoning and a solid analytical foundation.
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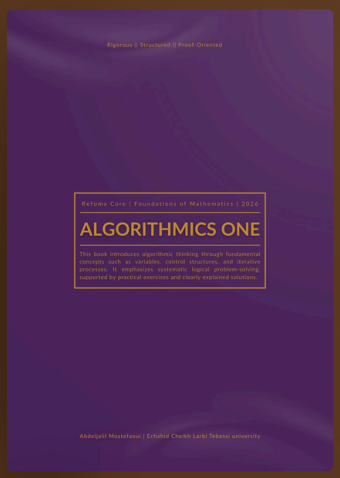
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ALGORITHMICS ONE
This book introduces algorithmic thinking through fundamental concepts such as variables, control structures, and iterative processes. It emphasizes systematic logical problem-solving, supported by practical exercises and clearly explained solutions.
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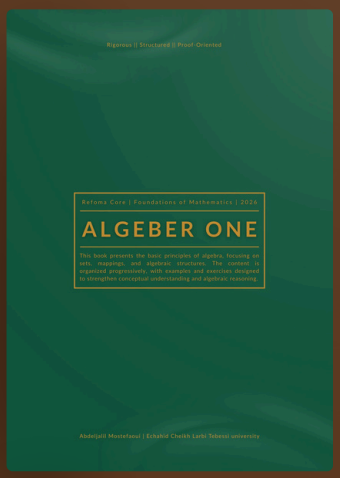
Rigorous || Structured || Proof-Oriented
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ALGEBER ONE
This book presents the basic principles of algebra, focusing on sets, mappings, and algebraic structures. The content is organized progressively, with examples and exercises designed to strengthen conceptual understanding and algebraic reasoning.
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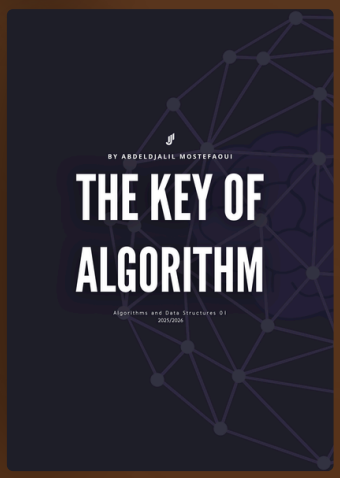

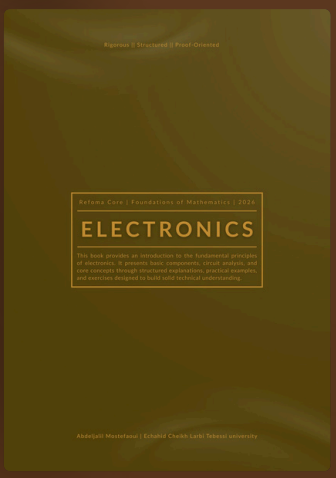
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